We claim:

1. A process for determining at least one candidate spectral endmember that represents a group of N spectra comprising:

building an initial endmember set composed of at least a first and a second spectrum representing at least a first and a second spectral characteristic expected to be in the group of N spectra;

unmixing the N spectra within the group of N spectra to determine what portion, if any, of each of the N spectra match at least one of the at least a first and second spectrum;

calculating a first metric value for each of the N spectra, wherein the first metric value accounts for a remaining portion of each of the N spectra not matching the at least a first and second spectrum;

defining a metric value range, wherein the N spectra having first metric values within the metric value range are defined as M spectra;

ordering the M spectra from highest first metric value to lowest first metric value;

comparing each of the M spectra, beginning with the M spectra having the highest first metric value, to each of the N spectra, to determine the frequency with which each of the M spectra occurs within the N spectra; and

calculating a second metric value for each of the M spectra, wherein the second metric value combines the frequency of occurrence of each of the M spectra within the N spectra with a first metric value for each of the M spectra, wherein the M spectra having the largest second metric value is the at least one candidate endmember.

2. The process according to claim 1, wherein the at least a first and a second spectra are selected from the group consisting of vegetation, shade, soil, and nonphotosynthetic vegetation.

3. The process according to claim 1, wherein the step of calculating a first metric for each of the N spectra includes defining an error value for each of the N spectra as the component not matching a combination of the at least a first and second spectrum.

4. A process for determining at least one candidate spectral endmember that represents a group of N spectra comprising:

building an initial endmember set composed of at least a first and a second spectrum representing at least a first and a second spectral characteristic expected to be in the group of N spectra;

unmixing the N spectra within the group of spectra to determine what portion, if any, of each of the N spectra match at least one of the at least a first and a second spectrum;

defining an error value for each of the N spectra, wherein the error value is the portion of each of the N spectra that does not match a combination of the at least a first and a second spectrum;

comparing the error value for each of the N spectra to a predetermined error value range, wherein spectra having error values within the predetermined error value range are defined as M spectra;

ordering the M spectra from highest error value to lowest error value;

comparing each of the M spectra, beginning with the M spectra having the highest error value, to each of the N spectra, to determine the frequency with which each of the M spectra occurs within the N spectra; and

calculating a metric for each of the M spectra, wherein the metric combines the frequency of occurrence of each of the M spectra within the N spectra with an error value for each of the M spectra, wherein the M spectra having the largest metric is the at least one candidate endmember.

5. The process according to claim 4, wherein the at least a first and a second spectrum are selected from the group consisting of vegetation, shade, soil, and nonphotosynthetic vegetation.

6. The process according to claim 4, wherein each error value corresponds to a residual spectra and the residual spectra in combination form a residual spectrum of the N pixels.

7. The process according to claim 6, further comprising calculating a root mean square (RMS) error value for each of the N pixels by combining the error values for the residual spectrum.

8. The process according to claim 7, wherein the step of comparing the error value for each of the N spectra to a predetermined error value range, wherein spectra having error values within the predetermined error value range are defined as M spectra includes:

determining an acceptable range of deviation from the mean RMS error;

comparing each of the RMS error values for each of the N pixels to the acceptable range of deviation from the mean RMS error and keeping the M pixels that are within the acceptable range.

9. The process according to claim 8, wherein the step of calculating a metric for each of the M spectra includes solving the following equations, wherein $K_x$ represents each of the M spectra, from x = 1 to x = an upper limit, RMSval($K_x$) is the RMS error value for the corresponding M pixel, RMSval(min) is the minimum RMS error value for the M spectra, RMSval(max) is the maximum RMS error value for the M spectra, RMSfreq($K_x$) is the value corresponding to the number of N pixels that match the residual spectrum for the corresponding RMS error value for the M pixel, RMSfreq(min) is the number of occurrences of the least frequently occurring residual spectrum from the M pixel residual spectra, and RMSfreq(max) is the number of occurrences of the most frequently occurring residual spectrum from the M pixel residual spectra,

$$\text{Normval}(K_x) = \frac{\text{RMSval}(K_x) - \text{RMSval}(\text{min})}{\text{RMSval}(\text{max}) - \text{RMSval}(\text{min})}$$

$$\text{Normfreq}(K_x) = \frac{\text{RMSfreq}(K_x) - \text{RMSfreq}(\text{min})}{\text{RMSfreq}(\text{max}) - \text{RMSfreq}(\text{min})}$$

$$\text{wgtfactor}(K_x) = \text{sqrt}(\text{Normval}(K_x) * \text{Normfreq}(K_x)).$$

10. A process for determining at least one candidate spectral endmember within a scene having N pixels using scene spectral data comprising:

building a first endmember, wherein the first endmember represents a first spectral characteristic expected to be in the scene;

building a second endmember for the scene, wherein the second endmember represents a second spectral characteristic expected to be in the scene;

unmixing the N pixels in the scene to determine what portions of each of the N pixels match at least one of the first and second endmembers;

defining a remaining portion for each of the N pixels not matching a combination of the first and second endmembers as an error value, wherein each error value corresponds to a residual spectra and the residual spectra in combination form a residual spectrum of the N pixels;

calculating a root mean square (RMS) error for the N pixels by combining the error values for the residual spectra;

determining an acceptable range of deviation from the mean RMS error;

comparing each of the RMS error values for each of the N pixels to the acceptable range of deviation from the mean RMS error and keeping the M pixels that are within the acceptable range of deviation;

ordering the M pixels from highest RMS error value to lowest RMS error value;

comparing the corresponding residual spectra of the M pixels, beginning with the M pixel having the highest RMS error value, to the residual spectrum comprising the residual spectrum for the N pixels, to determine the frequency with which each of the corresponding residual spectra of the M pixels occurs within the residual spectra for the N pixels; and

calculating a weighting factor for each of the M pixels, wherein the M pixel having the largest weighting factor is the at least one candidate endmember.

1. The process according to claim 10, wherein the first endmember is a shade endmember and further wherein the shade endmember is determined by a pre-selected baseline percentage of reflectance.

12. The process according to claim 11, wherein the second endmember is a vegetation endmember and further wherein the vegetation endmember is determined by comparing scene spectral data for the N pixels to a known set of vegetation spectra.

13. The process according to claim 11, wherein the second endmember is a soil endmember and further wherein the soil endmember is determined by comparing scene spectral data for the N pixels to a known set of soil spectra.

14. The process according to claim 11, wherein the second endmember is a nonphotosynthetic vegetation endmember and further wherein the nonphotosynthetic vegetation endmember set is determined by comparing scene spectral data for the N pixels to a known set of nonphotosynthetic vegetation spectra.

15. The process according to claim 12, wherein the step of comparing the scene spectral data for the N pixels to a known spectral data utilizes at least one spectral mapping algorithm.

16. The process according to claim 10, wherein the predetermined number of Z pixels is at most 500.

17. The process according to claim 10, wherein the step of calculating a weighting factor for each of the predetermined number of M pixels includes solving the following equations, wherein $K_x$ represents each of the predetermined number of M pixels, from x = 1 to x = an upper limit, RMSval($K_x$) is the RMS error value for the corresponding M pixel, RMSval(min) is the minimum RMS error value for the M spectra, RMSval(max) is

the maximum RMS error value for the M spectra, $RMSfreq(K_x)$ is the value corresponding to the number of N pixels that match the residual spectrum for the corresponding RMS error value for the M pixel, RMSfreq(min) is the number of occurrences of the least frequently occurring residual spectrum from the N pixel residual spectra, and RMSfreq(max) is the number of occurrences of the most frequently occurring residual spectrum from the N pixel residual spectra,

$$Normval(K_x) = \frac{RMSval(K_x) - RMSval(min)}{RMSval(max) - RMSval(min)}$$

$$Normfreq(K_x) = \frac{RMSfreq(K_x) - RMSfreq(min)}{RMSfreq(max) - RMSfreq(min)}$$

$$wgtfactor(K_x) = sqrt( Normval(K_x) * Normfreq(K_x)).$$

18. The process according to claim 10, wherein the step of comparing the corresponding residual spectrum of the M pixels, beginning with the M pixel having the highest RMS error value, to the residual spectra for the N pixels, to determine the frequency with which each of the corresponding residual spectra of the M pixels occurs within the residual spectrum for the N pixels utilizes at least one spectral matching algorithm.

19. The process according to claim 10, further comprising applying a shade mask to the unmixed pixels, such that only those of the N pixels not masked out are subject to the calculation of a root mean square error step.

20. The process according to claim 19, wherein the shade mask masks out the unmixed pixels comprised of greater than 80 percent shade.

21. The process according to claim 10, wherein the pre-selected baseline percentage of reflectance is at most 1 percent.

22. The process according to claim 10, wherein the scene spectral data is hyperspectral data.

23. The process according to claim 10, wherein the scene spectral data is multispectral data.

24. The process according to claim 10, wherein the scene spectral data is ultraspectral data.

25. The process according to claim 10, wherein the unmixing is linear.

26. The process according to claim 10, wherein the unmixing is non-linear.